Methodology for Assessing Community Health in Areas of Concern: Measuring the Adverse Effects on Human Health

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Scientific, Diplomatic, and Political Responses to Pollution in the Great Lakes

For more than 90 years, the International Joint Commission has been assisting the United States and Canadian governments in preventing and resolving potential disputes concerning the use of the boundary waters between the two countries, from coast to coast, under the Boundary Waters Treaty of 1909 (*1*). Because the International Joint Commission is a diplomatic organization that examines issues under dispute, it is both a political as well as a scientific organization. In the past 40 years, there has been a growing emphasis on water quality, particularly through the studies leading up to and subsequent to the signing of the 1972 Great Lakes Water Quality Agreement (*2*). In the 29 years since the signing, enormous progress has been made in documenting the adverse effects on many species and taxa of wildlife from exposures to persistent toxic substances and in formally demonstrating the causal links to specific pollutants. It has, however, proved more elusive to document the adverse effects on human health from exposures to pollutants.

In the late 1980s, Health Canada instituted its Great Lakes Health Effects Program, and in the early 1990s, the United States mandated the Agency for Toxic Substances and Disease Registry (ATSDR) to fund epidemiologic research through the Great Lakes Critical Programs Act (*3*). The ATSDR studies [reviewed in Johnson et al. (*4,5*)] confirmed that fish consumption is the major pathway of exposure to persistent toxic substances such as dioxin, polychlorinated biphenyls, and mercury, and identified at-risk populations including Native Americans and other minorities, sport anglers, the elderly, males and females of reproductive age, and fetuses and infants of mothers who consume contaminated Great Lakes fish (*4,5*). In human studies, increasing consumption of sport fish has been associated with difficulties in conception for Michigan sport fish anglers. ATSDR-funded research and other community-based studies have the ability to influence policy and public health practice. These thereby directly enhance the health status of vulnerable communities by identifying at-risk groups consuming Great Lakes sport fish and by disseminating outreach materials to educate the public about safe fish consumption.

Community Health and Areas of Concern

In the mid-1980s, the International Joint Commission expressed its concern about recurrent reports from the parties to the Great Lakes Water Quality Agreement of locations where water quality was out of compliance with water quality objectives, particularly in areas where pollution occurred from persistent toxic substances. These locations became known as Areas of Concern and were intended for special programs to restore water quality through the development and implementation of Remedial Action Plans (*2*).

Health Canada, through its Great Lakes Health Effects Program, undertook a research project to investigate whether the incidence rates of diseases were different in the 17 Canadian Areas of Concern compared with the incidence rates from the rest of the Province of Ontario and to generate hypotheses about whether these differences might be related to exposures to pollutants from local sources. The data and statistics in the reports were compiled from the national databases kept by Statistics Canada, for selected health end points that might be related to pollution; these included mortality, morbidity as hospitalization, congenital anomalies, and birth weights.

Partly as a result of the availability of the Health Canada reports, the International Joint Commission directed its Great Lakes Science Advisory Board to examine methodologies for assessing whether human health effects of pollution are occurring in communities in the Great Lakes basin. The Great Lakes Science Advisory Board hosted a Workshop on Methodologies for Community Health Assessment for Areas of Concern from 4–5 October 2000 in Windsor, Ontario, Canada. Publications in this issue of the Supplement are based on the presentations made at this workshop. The primary concerns were reliable interpretations of the health data and statistics for the Health Canada reports and the apparent absence of any comparable data for the Areas of Concern on the United States side of the Great Lakes. Much work has been undertaken on the incidence of cancers in communities. With recent publication of several articles documenting the experimental induction of a variety of effects from prenatal exposures to low doses of endocrine disruptors, there is now an urgent need for communities to investigate whether these subtle effects are occurring among individuals within their communities.

The Health Canada Reports

The 17 Health Canada reports on the health data and statistics in the communities in the Canadian Areas of Concern are part of an enormous database that could contribute to the formulation of statements that would provide a rational basis for remedial action plans to restore environmental quality under the Great Lakes Water Quality Agreement and under the Canada–United States Air Quality Agreement.

The interpretation of the reports has posed several challenges, including those associated with the diversity of health outcomes selected, useful ways of aggregating the end points into categories, and interpretation of the tables into comprehensible displays and narrative. Two approaches have been used in the interpretation of the reports: *a*) mapping of the distribution of the statistical significance of the ratio of the incidence rate for a particular health end point compared with the rate in the rest of the Province of Ontario; *b*) extended narrative of the elevated incidences of diseases or conditions within a population in a specific Area of Concern and comparisons with other locations with similar population size and racial profile; further statistical analyses are used to rank Areas of Concern on the basis of the aggregated severity of incidences of diseases and conditions and to select indices of environmental health.

The Health Canada reports were initially released to the Medical Officers of Health in each of the communities, each with its own

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particular social, economic, and political context. Dr. John Eyles of McMaster University (Hamilton, Ontario, Canada) conducted a brief survey of the responses of the Medical Officers of Health to these reports. Of particular concern to the Medical Officers of Health was the apparent disconnect between their opinions about environmental pollutants as determinants of health and those held by the communities. The Medical Officers of Health tended to believe that the populations in their Areas of Concern fared no better or worse than the Ontario and Canadian populations, that public trust in all government institutions, including public health, is fragile, and that the reports could, when there is no solution, frighten the public.

Contrasting the Scientific and the Public Health Approaches

The Great Lakes Science Advisory Board noted that there has been a significant debate recently about decision making in relation to the protection of public health. Mr. Horace Krever, who headed a commission that investigated a major public health disaster in Canada caused by the presence of the human immunodeficiency virus and hepatitis C in the blood supply, described the debates within the Canadian government over these issues. Pollution of the Great Lakes with persistent toxic substances may present several analogous situations, and the findings from the judicial investigation of the blood supply disaster may have important lessons for those involved in policy making under the Great Lakes Water Quality Agreement.

A major factor leading to the infection of so many people with a deadly virus was the influence of the traditional thinking of the scientists, when the method of the public health practitioners was more appropriate. There are essential differences between the scientific approach and the public health approach. The former was characterized by a refusal to accept that the illness could be spread by blood until Koch's postulates had been satisfied; this led to lengthy and undue delays in introducing the screening of blood donors and the subsequent testing of blood donations. The absence of definitive proof of a link between AIDS and blood transfusion was consistently used as a justification for maintaining the status quo. Strong action to reduce the risk of AIDS should not have required conclusive evidence. If there were even a possibility of transmission of the virus via blood, there was, above all, a moral and legal obligation to protect the blood recipient. Where there is reasonable evidence of an impending threat of public health, it is inappropriate to require proof of causation beyond a reasonable doubt before taking steps to avert the threat.

In environmental matters, this precautionary principle has become part of a number of international treaties and declarations, including the Second and Third International Conferences of the Protection of the North Sea concerning ocean dumping (*6,7*). Application of the precautionary principle is not problem free. First, in some cases, it will be evident after the fact that precaution was, with the benefit of hindsight, not necessary, and moreover, was costly. The second problem concerns the application of cost-benefit analysis, which should not be a deterrent in the application of the precautionary principle. Risk management is defective if it protects only the risk creators and not also the person suffering the harm when inevitably the risk accrues. For these circumstances, there should be no-fault compensation for victims of the harm created by the risk. The compassion of the society can be judged by the measures it takes to reduce the impact of the tragedy on its members.

What should we as a society do about polluters and about pollution? Should we close the businesses responsible for the pollution, thereby creating unemployment because the undertaking of preventive measures can be so cost prohibitive that the businesses become unprofitable? Or do we simply warn consumers of the products affected by the pollution? More philosophically, by what right do we, as the current and very temporary trustees of the environment, decide, even for apparently sound reasons, to permit the destruction of land and water?

References and Notes

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